

## Exhibit 4

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(54) Title: <b>CARTRIDGE HOLDER FOR PREPARING A CUP OF COFFEE WITH A SMALL-BUBBLE FOAM LAYER</b>		
(57) Abstract		
<p>An assembly comprising a filter holder (2) and a coffee filter (4) which, in use, is filled with ground coffee for preparing a cup of coffee with a small-bubble foam layer (cream coffee). The bottom (6) of the filter holder (2) is provided with at least one outflow (14) opening. The coffee filter (4) is removably positioned in the filter holder (2) at some distance from the bottom (6) of the filter holder (2). The coffee filter (4) is provided with a paper filter via which the coffee extract can flow out of the coffee filter in the direction of the bottom (6). Located between the lower side of the coffee filter and the bottom (6) of the filter holder is a separation plate (16) provided with at least one jet opening (18). Located between the lower side of the separation plate and the bottom of the filter holder is an interspace (20). Through the presence of the separation plate (16) a pressure is built up so that coffee extract will be forced out of the jet openings (18) into the interspace (20) with great velocity. Thus, bubbles are formed in the interspace (20) which, when they are not too large, can flow out of the filter holder (2) into a cup.</p>		

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Title: Cartridge holder for preparing a cup of coffee with a small-bubble foam layer

The invention relates to an assembly comprising a filter holder and a coffee filter which, in use, is filled with ground coffee for preparing a cup of coffee with a small-bubble foam layer, a bottom of the filter holder being  
5 provided with at least one outflow opening and the coffee filter being removably positioned in the filter holder at some distance from the bottom of the filter holder. The invention also relates to a filter holder of that assembly and to a coffee maker for preparing coffee provided with such  
10 an assembly.

Such an assembly is known from, inter alia, "Gebrauchsmuster" 295 02 595. In this known assembly two outflow openings are provided in the bottom. Placed on this bottom is a spherical element covering the two outflow  
15 openings. The spherical element consists of vertical side walls and a spherical top wall, a plurality of outflow openings being provided in the vertical side walls. The coffee filter comprises a refillable bowl-shaped element made of a rigid material, such as metal. The coffee filter is open  
20 on the upper side so that it can be filled by a user with ground coffee. Provided in the bottom of the coffee filter are fine-meshed openings, in a manner such that the bottom forms a barrier to ground coffee and a passage for the coffee extract formed in the coffee filter.

25 The operation of the known apparatus is as follows. First, the coffee filter is filled by a user with ground coffee. Then the coffee filter is placed in the filter holder. The filter holder is then connected to a coffee maker. The coffee maker passes hot water under high pressure  
30 to the coffee filter in the filter holder. In the coffee filter the ground coffee is pressed together to form a compact whole. Thus a high pressure is built up in the coffee filter. This has the result that the coffee extract is pressed outwards via the openings in the bottom of the coffee

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filter. When the coffee extract is pressed outwards, bubbles are formed in the space located in the filter holder between the bottom of the coffee filter and the top wall of the spherical covering. The bubbles present in this space, the cross-section of which exceeds the cross-section of the through-flow openings of the spherical covering, cannot leave this space and will therefore disappear. However, bubbles that are smaller will leave the filter holder via the openings in the spherical covering and the outflow openings in the bottom of the filter holder. Thus, via these outflow openings a coffee extract is delivered which can be collected in a cup placed under the assembly. In the cup filled with coffee extract a foam layer will be present on the coffee extract. It is a drawback of the known assembly that it is necessary to build up in the coffee filter a pressure for forming the bubbles. This involves that the coffee filter must be of completely rigid construction, so that it is impossible to make use of a paper filter; for in that case a compact coffee bed partly responsible for building up the high pressure will not be formed. The use of a coffee filter provided with a filter paper, however, has in the first place the advantage that a coffee extract having an improved taste is obtained. Moreover, such a coffee filter can be designed in an economically very advantageous manner so that this coffee filter may even be a disposable filter cartridge. A further drawback of the known apparatus is that the dimensions of the openings of the coffee filter are based on a compromise. On the one hand, the openings must not be too large because coffee grains are not allowed to pass. On the other hand, the openings must be large enough to enable the formation of a jet suitable for generating bubbles.

The assembly according to the invention removes these drawbacks and is characterized in that the coffee filter comprises a paper filter via which coffee extract can flow out of the coffee filter in the direction of the bottom and that a separation plate provided with at least one jet

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opening is located between the lower side of the coffee filter and the bottom of the filter holder, an interspace in which, in use, bubbles are formed being located between the lower side of the separation plate and the bottom of the filter holder.

When in the assembly according to the invention hot water is supplied to the filter holder, this hot water will extract in the ground coffee contained in the coffee filter. Since the coffee filter comprises a paper filter, the hot water will in the first instance flow through the coffee filter without a high pressure being built up in the coffee filter. The separation plate, however, results in a high pressure being built up yet on the side of the separation plate where the coffee filter is located. The coffee extract will be forced out through the jet openings of the separation plate into a layer of extract already collected on the bottom of the filter holder and that with an intensity such that bubbles are formed in the above-mentioned interspace. The coffee extract, together with at least part of the bubbles formed, can leave the filter holder via the at least one outflow opening to fill a cup. Thus the cup is filled with coffee extract provided with a foam layer. An advantage is that the separation layer can be optimally dimensioned to generate bubbles; for the separation layer does not function as a filter.

Preferably, the separation plate is a screen plate comprising a plurality of screen openings each having a through-flow surface much smaller than the through-flow surface of the at least one jet opening. It turns out that with such a separation plate a foam is formed, the foam picture of which on the coffee is optimal. In particular, the coffee filter is a disposable cartridge. This has the advantage that the dosage is optimal. In particular, the bottom of the coffee filter mainly consists of filter paper to obtain the above-mentioned optimum taste.

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The invention will now be explained in more detail with reference to the accompanying drawings in which:

Fig. 1A is a cross-sectional view of a possible embodiment of an assembly according to the invention comprising a cartridge holder with a coffee filter cartridge placed therein;

Fig. 1B is a top view in the direction of the arrow P shown in Fig. 1A of the cartridge holder without coffee filter cartridge;

Fig. 2A is a bottom view of the coffee filter cartridge of Fig. 1A;

Fig. 2B is a top view in the direction of the arrow P shown in Fig. 1A of the coffee filter cartridge of Fig. 2A;

Fig. 2C is a cross-sectional view of the coffee filter cartridge of Fig. 2A;

Fig. 3 is a cross-sectional view of a part of the separation plate 16 of Fig. 1; and

Fig. 4 is a cross-sectional view of an outflow opening of the assembly of Fig. 1.

In Fig. 1A reference numeral 1 denotes a possible embodiment of an assembly according to the invention. The assembly comprises a filter holder 2 and a coffee filter 4 which is removably placed in the filter holder 2. In this example the coffee filter 4 is a disposable coffee filter cartridge 4.

The filter holder 2 comprises a preferably bowl-shaped bottom 6 and a vertical side wall 8 extending from the bottom 6 upwards. The vertical side wall 8 is provided at its upper end with a flange 10 radially extending from the filter holder 2 outwards. Proportionally distributed over the circumference of the flange are, for instance, four projections 12 used for coupling the filter holder to a coffee maker. In this example two outflow openings 14 are provided in the bottom 6 of the filter holder 2. The vertical side wall 8 is provided on the inside with a flange 15

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radially extending inwards and supporting a separation plate 16.

In this example the separation plate is provided with four rectangular jet openings 18. Located between the lower side of the separation plate 16 and the bottom 6 of the filter holder is an interspace 20. As shown in Fig. 1A, the separation plate 16 is, in this example, disposed right under the coffee filter cartridge 4.

In this example the coffee filter cartridge 4 is a disposable cartridge with a bottom 22, a top wall 24 and an upright side wall 26 connecting the bottom 22 and the top wall 24 together. The top wall 24 is provided on the outside with a flange 28 radially extending outwards. The side wall 26 and a part of the bottom 22 are made of a rigid material, in this case, for instance, plastic. The rigid part of the bottom 22 has the form of a cross 30, in the middle of which cross 30 a circular plate 32 is formed. The rest of the bottom 22 consists of filter paper 34. The filter paper is connected near its circumferential edge 36 to a rigid part of the bottom 22. In this example the top wall 24 is completely made of filter paper which is connected near its circumferential edge 38 to an upper edge 40 of the upright side wall 26. The coffee filter is filled with a quantity of ground coffee 42.

When the coffee filter cartridge is placed in the filter holder 2, the coffee filter cartridge 4 rests with its flange 28 on the flange 10 of the filter holder. The assembly is now ready for use. For this purpose, the assembly is connected to a coffee maker (not shown). At the top of the filter holder 2 the coffee maker supplies hot water to the filter holder 2 and thus to the coffee filter cartridge 4. This water will reach the ground coffee 42 in the coffee filter cartridge 4 via the filter paper 34. The ground coffee will thus be extracted. The coffee extract then leaves the coffee filter cartridge 4 via the filter paper 34. In the first instance, no appreciable high pressure will then be



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built up in the coffee filter cartridge 4. This is due to the fact that the filter paper easily passes the coffee extract. On the other hand, the filter paper forms a barrier to the ground coffee.

5       The coffee extract then flows in the direction of the separation plate 16. As a result of the separation plate the through-flow of the coffee extract will be retarded. This has the result that a high pressure is gradually built up in the space 44 above the separation plate, that is to say in the  
10 space above the separation plate of the filter holder in which the coffee filter cartridge 4 is located. When the pressure has been built up, the coffee extract will be forced out of the jet openings 18 into the interspace 20. In the interspace 20 bubbles will be formed as a result of the force  
15 of the jets and the layer of coffee extract from the jet openings 18 already collected on the bowl-shaped bottom 6. The space 44 is therefore important for building up a liquid pressure so that coffee extract is going to be forced out of the jet openings into the space 20. The space 20 with the  
20 bowl-shaped bottom partly filled with coffee extract is then important so that the above-mentioned jets can form bubbles. Bubbles having dimensions smaller than the through-flow surfaces of the outlet openings 14 will flow, together with the coffee extract, via the outlet openings to a cup which,  
25 in use, is placed under the filter holder. As a result of the dimensions of the outflow openings very large bubbles cannot leave the interspace. This has the result that only bubbles having a desired maximum diameter can flow out of the filter holder, together with the coffee extract. In this example  
30 each outflow opening is subdivided into four partial outflow openings 48 (see Fig. 4). Each partial outflow opening 48 forms a through-flow surface having a diameter of, for instance, 1-5 mm. In this example the diameter d of each outflow opening 14 is approximately 6 mm.

35       Thus the cup is filled with coffee, on which a foam layer will be present. This is also called "cream coffee".

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In particular, the diameter of the jet openings 18 increases in the direction of the coffee filter cartridge towards the bottom 6 (see also Fig. 3). This prevents the jet openings 18 from being easily clogged. In particular, the separation plate 16 is a screen plate comprising a plurality of screen openings 46 having a through-flow surface much smaller than the through-flow surface of the jet openings 18. Here, too, the diameter of the screen openings will preferably increase in the direction from the coffee filter cartridge to the bottom 6 of the filter holder (see also Fig. 3). The size of the surface of the smallest cross-section of a screen opening is, for instance, 3-10 times smaller than the size of the smallest cross-section of the jet openings 10. The size of the surface of the cross-section of the jet openings is at least 0.1 mm<sup>2</sup>. Preferably, the size of the surface of the cross-section of each jet opening is at least 0.15 mm<sup>2</sup>. In this example the jet openings are rectangular in cross-section with a dimension of approximately 1.4 by 0.15 mm. In this example the smallest diameter of each of the above screen openings is approximately 0.2 mm.

For completeness' sake, it is observed that the invention is by no means limited to the above-described possible embodiment. Thus, for instance, the separation plate 16 can be disposed nearer to or farther from the coffee filter cartridge. Also, the coffee filter 4 may be of a type open on the upper side and therefore suitable for repeated use, by emptying the coffee filter 4 after use and then filling the coffee filter again with freshly ground coffee. Moreover, the number of jet openings can be varied. Thus it is also conceivable that the separation plate is provided with 6, 8 or more jet openings. Such variations are all deemed to fall within the scope of the invention.

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# CLAIMS

1. An assembly comprising a filter holder and a coffee filter which, in use, is filled with ground coffee for preparing a cup of coffee with a small-bubble foam layer, a bottom of the filter holder being provided with at least one outflow opening and the coffee filter being removably positioned in the filter holder at some distance from the bottom of the filter holder, characterized in that the coffee filter comprises a paper filter via which coffee extract can flow out of the coffee filter in the direction of the bottom and that a separation plate provided with at least one jet opening is located between the lower side of the coffee filter and the bottom of the filter holder, an interspace in which, in use, bubbles are formed being located between the lower side of the separation plate and the bottom of the filter holder.
2. An assembly according to claim 1, characterized in that the bottom of the filter holder is bowl-shaped.
3. An assembly according to claim 1 or 2, characterized in that the bottom of the coffee filter at least mainly consists of filter paper.
4. An assembly according to claim 1, 2 or 3, characterized in that the separation plate is a screen plate comprising a plurality of screen openings having a through-flow surface much smaller than the through-flow surface of the at least one jet opening.
5. An assembly according to claim 4, characterized in that the diameter of the screen openings increases in the direction of the coffee filter towards the bottom of the filter holder.
6. An assembly according to claim 4 or 5, characterized in that the size of the surface of the smallest cross-section of

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a screen opening is 3-10 times smaller than the size of the smallest cross-section of the at least one jet opening.

7. An assembly according to any of the preceding claims, characterized in that the diameter of the at least one jet opening increases in the direction of the coffee filter cartridge towards the bottom of the filter holder.

8. An assembly according to any of the preceding claims, characterized in that the smallest cross-section of the at least one jet opening has such dimensions that, in use, a coffee extract jet is forced into the interspace.

9. An assembly according to any of the preceding claims, characterized in that the size of the surface of the cross-section of the at least one jet opening is at least  $0.1 \text{ mm}^2$ .

10. An assembly according to claim 9, characterized in that the size of the surface of the cross-section of the at least one jet opening is at least  $0.15 \text{ mm}^2$ .

11. An assembly according to any of the preceding claims, characterized in that the at least one jet opening is rectangular in cross-section.

12. An assembly according to any of the preceding claims, characterized in that the separation plate is provided with a plurality of jet openings.

13. An assembly according to claim 12, characterized in that the separation plate is provided with 4-6 jet openings.

14. An assembly according to any of the preceding claims, characterized in that the coffee filter is a disposable filter cartridge filled with ground coffee.

15. An assembly according to any of the preceding claims, characterized in that the coffee filter consists of a bottom, an upright side wall, and a top wall, at least part of the bottom and the top wall being formed by filter paper.

16. An assembly according to claim 15, characterized in that the coffee filter is a disposable coffee filter cartridge.

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17. An assembly according to any of the preceding claims, characterized in that the at least one outflow opening has at least one through-flow surface having a diameter of 1-5 mm.

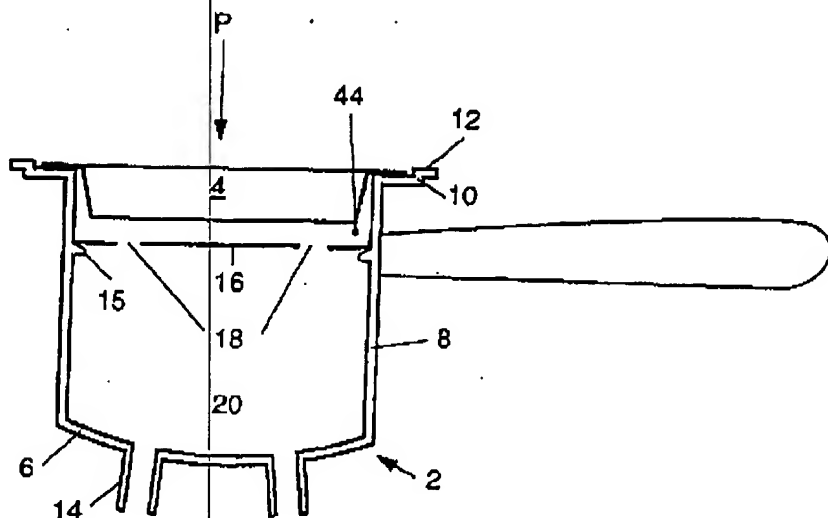
18. A filter holder of the assembly according to any of the  
5 preceding claims.

19. A coffee maker for making coffee provided with an assembly according to any of the preceding claims 1-17.

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1 FIG. 1A

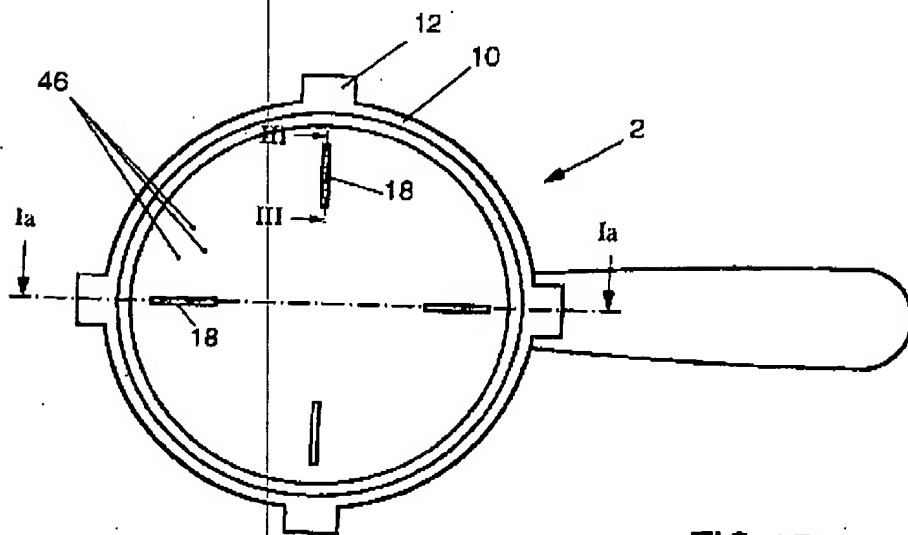


FIG 1B

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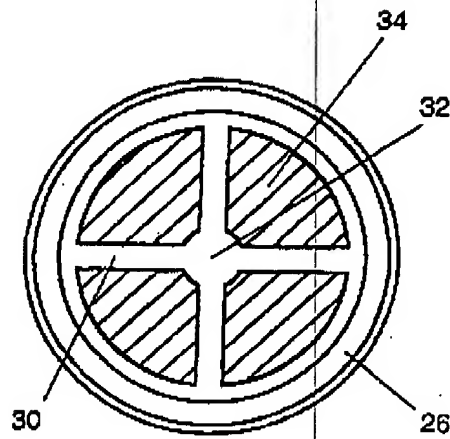


FIG. 2A

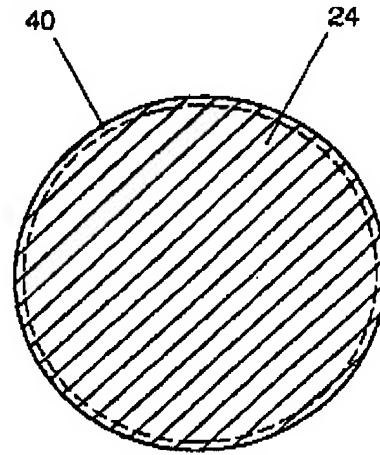


FIG. 2B

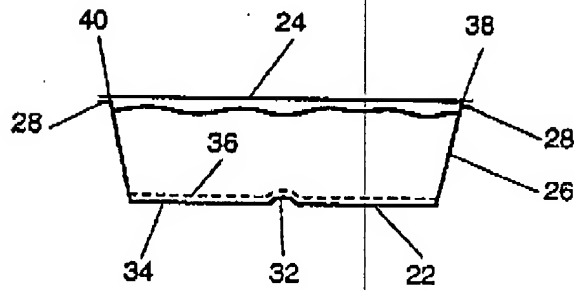


FIG. 2C

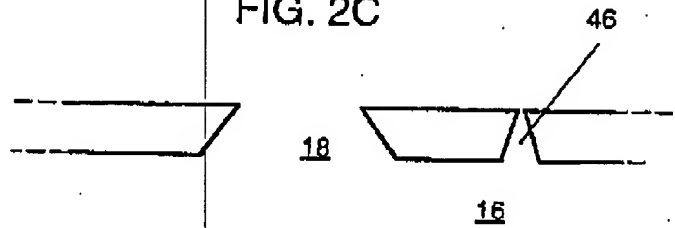


FIG. 3

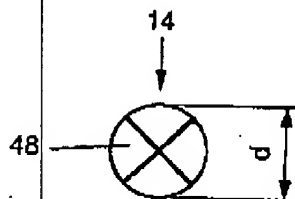


FIG. 4

# INTERNATIONAL SEARCH REPORT

<p>Int. Application No B0200/96 NL/171</p>		
<p><b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC 6 A47J31/06</p>		
<p>According to International Patent Classification (IPC) or to both national classification and IPC</p>		
<p><b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) IPC 6 A47J</p>		
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<p><b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b></p>		
Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2 636 828 A (SOLER SAEZ DANIEL) 30 March 1990 see the whole document ---	1
A	DE 295 02 595 U (EUGSTER ARTHUR AG) 30 March 1995 cited in the application -----	
<p><input type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex.</p>		
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<p>Date of the actual completion of the international search 30 July 1997</p>		<p>Date of mailing of the international search report 07. 08. 97</p>
<p>Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 H1V Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016</p>		<p>Authorized officer Verdoordt, S</p>

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2636828 A	30-03-90	PT 89784 B	30-09-94
DE 29502595 U	30-03-95	EP 0727164 A	21-08-96

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